DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR
RESEARCH, DEVELOPMENT, AND ACQUISITION
WASHINGTON, D. C. 20310

REPORT OF THE

ARMY SCIENTIFIC ADVISORY PANEL

AD HOC GROUP

ON

PRODUCT IMPROVEMENT II

FEBRUARY 1977

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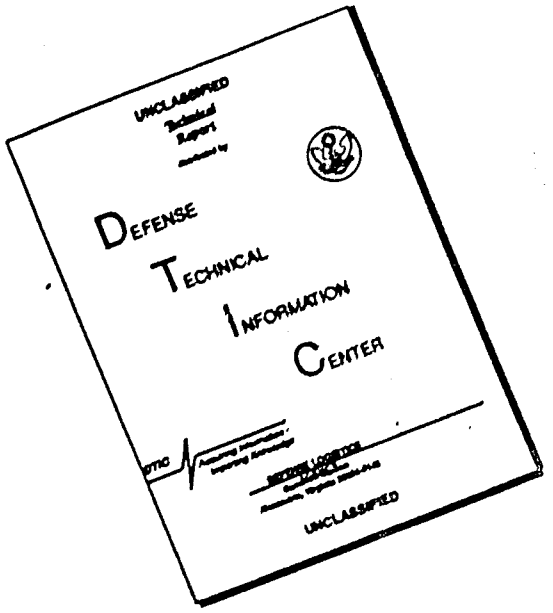

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Report of the

Army Scientific Advisory Panel Ad Hoc Group

on

Product Improvement II

BACKGROUND:

This is the report of the Continuing Ad Hoc Group on Product Improvement. The PI II Group was formed by Dr. Marvin Lasser in November of 1974 in response to a recommendation of the first group which was chaired by Dr. James J. Renier. Appendix A is a membership list of the PI II Ad Hoc Group. The Study Proposal and the Terms of Reference (TOR) dated April 1973, are included for reference purposes as Appendix B. The summary of Conclusions and Recommendations of the first Ad Hoc Group are also included for purposes of reference of the reader of this report in Appendix C. We note that the original TOR guided the activities of the ASAP PI II Panel.

Whereas the first group investigated the Product Improvement Processes in a rather general way with an aim of identifying ways and means of improving the effectiveness of the processes, the second group was asked to study the processes of product improvement by in-depth investigations of three major PI programs, namely:

1. M107/M110 P.I. Program

2. M60A1 P.I. Program

3. OV1-D P.I. Program

A letter by Dr. James Renier to Dr. Marvin Lasser explaining further the rationale for choosing these three costly P.I. Programs for further study, is included in Appendix D and should be reviewed by the reader of this report. We visited three commands responsible for the selected weapons. The meetings were most informative and provided the background for this report. Appendix E is a list of attendees at each of the visits.

The United States Army continues to rely heavily on the Product Improvement Process to provide it with materiel having the satisfactory reliability and performance to meet current threat and assure adequate combat readiness. To give an indication of the magnitude of the Product Improvement effort and the growth both in number of programs and either actual or planned dollar value, we include Figure 1 which was provided quite recently by Colonel L.A. Gimple, Chief, Office of Product Improvement. Figure 2 gives a breakdown of the dollar value and number of PIP's for the years FY 76, 77, and 78. The dominance of the three classifications of new Tactical Opportunities, Combat Effectiveness and RAM-D is evident with RAM-D taking progressively smaller fractions of the dollars in these

projections. Also to be noted is the apparent, if slight increase in attention to cost reduction. The increase in emphasis on energy conservation is worthy of note. These estimates recognize that we shall continue to rely on the Product Improvement Process as a "way of life" for the Army's highly sophisticated modern equipment.

The purpose of this in-depth investigation of three major P.I. Programs was then to:

(a) Further study the process by specific examples, report observations and conclusions and make recommendations that would provide guidance for the improvement of the process.

(b) Make recommendations for the continuing involvement of ASAP expertise in the Product Improvement Process.

One of the major observations of the Ad Hoc Panel for Product Improvement, as stated in the September 1974 report, was the lack of a staff organization that would coordinate, evaluate, and help sell Product Improvement Programs. The establishment of the Office of Product Improvement reporting to the Deputy Commanding General for Material Development, DARCOM, in December of 1974 was a very important step forward. Colonel Lloyd A. Gimple, in November of 1974, performed a special study at the direction of General Sammet, which further identified the need and opportunities of such a Central P.I. Office. The Office is to have a staff of 18, with 8 in Technical Management, 7 in Program Control, and 3 in the Chief's Office. The prime functions of the Office are as follows:

1. Encouragement and contributions to studies which will compare the cost and the performance prospects of Product Improvements of existing items in competition with proposed new developments.

2. Control of PIP Process and management total PI Program. Tracking of budgets, programs by areas such as aviation, armaments, etc. Product Improvement budgets are formulated at the Commodity Commands using programming guidance from Higher Headquarters. Assist in reprogramming and priority establishment as need arises. This is a very important function.

3. Control disciplined review of major PI proposals as prepared by Commodity Commands on a systems assessment basis. Develop integrated PI Program perspective.

4. Streamline and expedite documentation requirements. Expedite approval processes. Develop "any time PIP submission."

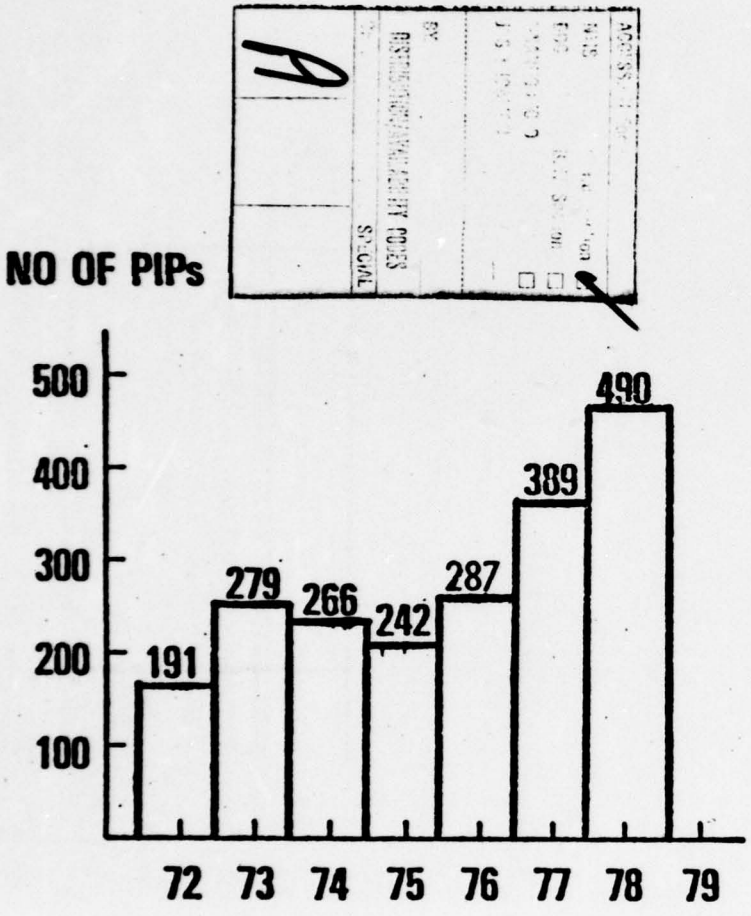
5. Worldwide responsibility for modification kits - funding provisioning and installation. This is a new responsibility for DARCOM.

6. Manage the Army PI Program.

PRODUCT IMPROVEMENT

PROGRAM GROWTH

NUMBER OF PIPs BY YEAR



($M) DOLLARS BY YEAR

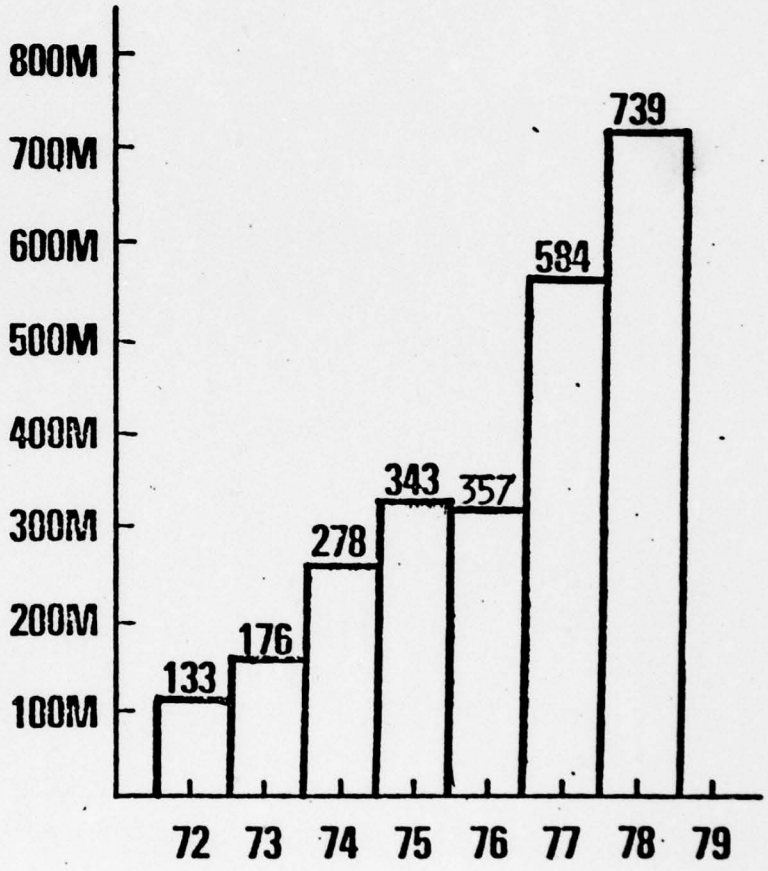


FIGURE 1

STRATIFICATION OF PI PROGRAMS

FISCAL YEAR

TYPE	1976				1977				1978			
	# of PIP	%	$ Value in Millions	%	# of PIP	%	$ Value in Millions	%	# of PIP	%	$ Value in Millions	%
Safety	51	17.8	17.134	4.8	63	16.3	21.608	3.7	69	14.1	49.513	6.7
New TAC/OP User Rqrmt.	54	18.8	147.77	41.4	63	16.3	206.736	35.4	104	21.2	232.046	31.4
Combat Effectiveness	45	15.7	78.906	22.1	64	16.5	185.712	31.8	71	14.5	223.178	30.2
RAM-D	94	32.8	80.422	22.5	124	31.6	120.304	20.6	145	29.6	128.586	17.4
Cost Reduction	11	3.8	3.384	0.9	30	7.8	8.176	1.4	39	7.9	14.780	2.0
Energy Conservation	1	0.3	3.3	0.9	2	0.5	35.040	6.0	5	1.0	67.249	9.1
Standardization Compat., Other	31	10.8	26.145	7.3	43	11.0	6.424	1.1	57	11.7	23.648	3.2
	287	100.0	375.059	100.0	389	100.0	584.000	100.0	490	100.0	739.000	100.0

FIGURE 2

The Ad Hoc Group has been impressed by Colonel Gimple's excellent leadership of the Office of Product Improvement, its efficient operation, and apparent impact on the process.

In order to fulfill the charge given us, we requested, prior to our visits, that information be developed by each command's project or program office in the following areas of interest.

Of particular concern to the Ad Hoc Group was the history of the initiation and development of the PIP with specific attention to the identification and communication processes of the series of technical or other problems with the system. The decision-making processes that finally resulted in the approval of the PIP are subjects of major interest as are the related trade-off studies between deficiency correction, long-life improvements and performance improvements. A question exists as to how the various supporting commands were involved in the process and what were their roles at various stages. Related to this involvement were the communication channels, their timing, their depth and their effectiveness in influencing the process.

The visit to the three commands was preceded by considerable preparation to assure that our time could be effectively utilized. The careful staff work of Mr. Eugene Carbonneau and LTC Harold Ford, are particularly appreciated. The Project Managers' Offices provided each member of the Ad Hoc Group with much useful background literature prior to the visits so that we were reasonably well prepared to conduct the discussions.

FINDINGS OF AD HOC GROUP

Introduction:

Since each of the programs studied differed markedly from the others in terms of the weapons system status, certain of our observations were unique to the particular program while several observations permit us to make general recommendations on how to improve the process. The order in which we present our findings is not necessarily a listing of priorities.

1. UNCERTAIN DOCUMENTATION OF PRODUCT IMPROVEMENT PROGRAM DECISIONS

a. Findings: There appeared to be considerable confusion and uncertainty about the procedure for documenting of decisions reached and descriptions of the consensus agreements during the Product Improvement Program processes, and particularly, the frequent changes in the PI Program definition.

b. Discussion: We observed during both Ad Hoc Group meetings, first under Dr. Renier's Chairmanship for the first Product Improvement Process study, and more recently with the study of the M107/M110 Program, the M60A Program, and particularly, the OV-1 Program, the almost yearly reprogramming of the PIP Programs appears to be the normal modus operandi. The reason for this reprogramming exercise was not too difficult to find.

With PIP funds very tight, DARCOM (formerly AMC) management had very little discretionary funding available to respond to new emergencies. It became, therefore, necessary to stretch out some programs, and cancel others in order to be able to initiate new programs of higher priority.

The OV-1 conversion program is a case in point. Although this PIP has experienced a somewhat larger share of reprogramming than most, in the form of stretch-outs, cancellations, and resurrections, it is still rather typical of the problems encountered by the process.

The OV-1 conversion program was preceded in 1965 by a request for the definition of an advanced surveillance system to replace the OV-1 "Mohawk." The very costly plan for the "MAVS" with its multi-sensor platform and side-looking radar, was rejected by DA primarily because of high first cost and complexity in early 1966. A product improved "interim" OV-1, the OV1-D program was improved in May 1966. Four OV1-C aircraft were modified to OV1-D's and passed TECOM tests. Full-scale production was also started on 37 new OV1-D aircraft in 1967-68. Then in 1970, production of OV1-D was stopped because of funding limitations. As needed for additional surveillance aircraft still existed, DA requested plans for converting existing OV1-B and OV1-C aircraft to essentially OV1-D capability. Four alternatives were studied. PIP1-72-01-001 was finally submitted to AMC in April of 1972, with initial funding for the conversion of 86 OV-1 aircraft to start FY 73. Production was to take place over five years. Fiscal 74 saw budget reductions resulting in delays in procurement and resulting increases in unit cost. FY 75 saw again budget reductions resulting in A/C quantities reduced from 24 to 9. Similar reprogramming changes were made for FY 76. The result has been much confusion and an increase in aircraft unit cost.

We learned that such reprogramming requires careful documentation so that rationale for decisions is available to new project personnel who follow in the typical frequent turnover of key project personnel. The Letter of Agreement (LOA) which has recently been instituted, should alleviate some of the earlier problems caused by delayed implementation. Furthermore, the earlier Material Need (MN) documents, now called the ROC, must be kept up to date and continue to serve as the guiding element in the PIP process.

This would require a change from the present system wherein the ROC is considered complete when the item is type classified and removed from the active file. The data contained in the ROC would be valuable to those involved in the item's PIP.

We encountered similar problems with decision process documentation in our study of the M60A1 Product Improvement Program. The PIP's were submitted on 13 major items to DA. It should be noted that the Material Need document was established <u>after</u> the submittal of the PIP document. We had difficulty establishing documentation of the many decisions. Many people appeared to rely on memory. The approach above would help to eliminate this rather time-consuming, irritating, and managerially unsound past practice. Timely input from all responsible contributors would be assured.

c. Recommendations:

(1) The Product Improvement Office of DARCOM should review current practices of documenting decisions in the PIP processes at the various commands. Particular emphasis should be placed on review by TRADOC and threat analysis activities.

(2) The ROC and associated early Material Need documents should be updated and maintained for guidance to those involved in an item's PIP Program.

(3) The Product Improvement Office should periodically review documentation processes to assure compliance with AR's.

(4) The retention of documentation and the process of PIP by means of LOA's, ROC's, and the PIP documents should be carefully spelled out in Army regulation documents.

2. ASAP SHOULD PLAY A CONTINUING ROLE IN CERTAIN TYPES OF PRODUCT IMPROVEMENT PROGRAMS

a. Findings: The technical and managerial expertise possessed by the members of ASAP should be utilized in several of the seven categories of Product Improvement Programs. The specific involvement of ASAP personnel should be tailored to meet the specific needs of the programs and in recognition of the limited time available by ASAP members. The Summer Study Program of ASAP could further serve to approach specific PI tasks with greater concentration than would be possible under everyday circumstances.

b. Discussion: The Product Improvement Office has categorized the Product Improvement Programs into seven areas, namely:

(1) Safety

(2) New Tactical, Operational User Requirements

(3) Combat Effectiveness

(4) Reliability, Availability, Maintainability, and Extended Life

(5) Cost Reduction

(6) Energy Conservation

(7) Standardization, Compatibility, Compliance with Public Laws.

The relative magnitude of each of these areas in terms of cost and number of PIP's was given in Figure 2 earlier. We see that most of the costs go to Increased Combat Effectiveness and new User Requirements. There is

also increasing attention being given to Energy Conservation. Deficiency corrections continue to occupy a sizeable portion of the PI effort. We believe that classes 3, 4, and 6 can benefit particularly by ASAP involvement. Each major PIP in these categories should have long-range tentative objectives carefully developed on the basis of natural limits of growth or predicted obsolescence. A PI plan should be established which delineates the logical steps toward meeting these objectives and implemented by programmed suitable block changes recognizing the logistics of the weapons system. Such plans should be reviewed annually and careful consideration should be given to the trade-offs between product improvement and the state-of-the-art relative to new development prospects. ASAP members could make significant contributions to such studies.

A continuance of the Ad Hoc Group on Product Improvement seems to be appropriate. Areas that have not been considered or in which further work is necessary are:

(1) Considerations on how the decisions to "Product Improve" are made.

(2) Techniques for development and production such that projected "state-of-the-art" and evolutionary changes may be incorporated at a later date.

The need to establish a method of identification of Product Improvement at an early date and to then proceed is essential to combat readiness and serviceable equipment.

b. Recommendations:

(1) Establish a mechanism whereby ASAP Ad Hoc Groups can be called into session to work on particular problems of a nature which lend themselves to the short-term intensive involvement of ASAP expertise.

(b) Use ASAP Summer Program as a resource to contribute to definition of certain PIP Programs and, in particular, resolve carefully chosen product improvement versus new development dilemmas.

(3) Continue Ad Hoc Committee with charter to look at mechanism of decision and development methodology for PIP.

3. **THE TIME ELAPSED FROM PROBLEM DEFINITION TO A NEEDED PRODUCT IMPROVEMENT TO RETROFIT OF WEAPONS SYSTEM FOR MAJOR SYSTEMS APPEARS TO BE EXCESSIVE IN COMPARISON WITH OBSOLESCENCE CONSIDERATIONS.**

a. Discussion: The time span required from the first identification of a needed major product improvement program to the retrofit of fielded hardware, typically takes from 5 to 7 years. In view of the fact that obsolescence typically occurs 6 to 8 years after introduction of a weapons system into operational service, this time span appears to be far too long.

We were told that it takes about 2 years to get a PIP into the budget cycle, one to two years for engineering, one to two years for the production of kits, and then one year for the retrofit of the fielded items. We note that this process only starts after the PIP document has been prepared. Funding and resources for the engineering necessary to prepare such a document, are a separate consideration.

The M60A1 Product Improvement Program is a typical example. Another example is the M110/M107 PI Program which started in 1972 with retrofit beginning in 1978.

We are informed that one of the functions of Colonel Gimple's operation is to investigate this problem and to propose the necessary administrative and budget cycle changes. Based on several discussions between DARCOM and DA personnel, we believe that the budget cycle problem will not be susceptible to easy solution.

b. Recommendations:

Present the long PIP implementation time problem to General Officer Product Improvement Review Board so that it receives high level attention.

4. TRADOC DOES NOT APPEAR TO PLAY ITS DESIGNATED ROLE AS USER REPRESENTATIVE IN THE PRODUCT IMPROVEMENT PROCESS.

a. Discussion: Based on the poorly informed or absence of TRADOC representation at two of the three meetings, this present Ad Hoc Group on Product Improvement held, as well as the meetings of the first Ad Hoc Group, in addition to remarks by many participants, we can only conclude that TRADOC's influence on the process is essentially nonexistent. The TRADOC/DARCOM interface requires highest DA attention as TRADOC's inaction appears to have resulted in its being bypassed with Project Directors going directly to field operations to obtain necessary information. We understand that the Product Improvement Office of DARCOM is developing a joint coordination procedure. Colonel Gimple is to be commended for taking this initiative.

b. Recommendations: Assurance should be provided by TRADOC Headquarters that the TRADOC/DARCOM interface meet the AR requirements. Such a review could be performed by an Ad Hoc ASAP Group.

5. MOST EFFECTIVE MEANS OF EARLY AND TECHNICALLY COMPLETE PROBLEM IDENTIFICATION IN FIELD IS OBTAINED BY REPRESENTATIVES IN FIELD AND AT OVERHAUL STATIONS.

a. Discussion: One of the cornerstones of an effective Product Improvement Program in the sense of deficiency corrections, is timely and complete technical data from the user. Several commands, particularly AVSCOM and the M60 project in TACOM, have recognized this reliability data feedback problem and placed specially trained and well-motivated technicians in the field and at overhaul stations to fulfill this need. EIR's will only meet some aspect of the problem. The broader problems can be solved by the implementation of a "Data Collection and Assessment Methodology,"

based on a sample data approach. The Office of the Director of Quality Assurance has proposed such a system early in 1976. The system will provide the technical detail as well as the needed statistical data base to identify operational and product support cost problems and also permit the estimation of wear-out effects. Such data is essential to back up Product Improvement Proposals. We hope that this carefully worked out proposal will receive the careful attention it deserves and will see early implementation.

b. Recommendations:

(1) Adopt a field maintenance technician approach similar to that used in the M60 program in Europe and the field representative approach used successfully by AVSCOM to major equipment items.

(2) Adopt the proposed "Data Collection and Assessment Methodology" throughout the Army on a sample data basis.

6. MECHANISM IS NEEDED WHEREBY ARMY CONTRACTORS ARE ENCOURAGED TO SUBMIT PRODUCT IMPROVEMENT PROPOSALS ON EXISTING EQUIPMENT OF THEIR MANUFACTURE, REFLECTING LATEST STATE-OF-THE-ART.

a. Discussion: We noted that the enterprising and technically advanced contractor will submit Product Improvement Proposals if he sees a competitive or financial advantage. The hydro-pneumatic suspension system for tanks developed by National Water Lift, is one example. The Army will benefit by this development in both advanced versions of the M60 Tanks and the XMI Tank.

A mechanism should be developed to encourage such developments by either encouraging the submittal of unsolicited proposals or by producing modest funds from PEMA resources on a continuing basis. This latter practice has proven very successful in assuring the continuing development of military jet aircraft engines. The J79 program at General Electric Company in Evandale, Ohio, is a good example. Funding may introduce new problems, but some techniques are needed to assure the Army that the latest "State-of-the-Art" is being applied to the PIP Process. Our current system does not appear to be bringing forth the desired new, innovative ideas.

b. Recommendations: Explore and implement means to encourage the development of product improvements which extend the useful life of Army equipment by having the contractor submit Product Improvement Proposals which reflect latest state-of-the-art.

APPENDIX A

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Army Scientific Advisory Panel
Washington, DC 20310

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APPENDIX B

ASAP Study Proposal

1. Proposed Name: ASAP Ad Hoc Group on Product Improvement

2. Statement of the Problem: To review, describe and assess potential and proposed product improvements of Army materiel systems.

3. Considerations:

a. The key to coping with threats facing the Army is to find ways to improve its utilization of modern technology for ground warfare. There are three ways of acquiring a new capability. These are new development, a commercial "off-the-self" acquisition or product improvement of existing systems.

b. Product improvement provides a means by which better performance and extended life can be obtained from a system without investing in new development starts. A viable product improvement program includes an assessment of the effect of a proposed improvement on force effectiveness. It includes an analysis of the improvement in terms of the projected threat for the period during which the improvement would be applied and used. Finally, a proposal to product improve a system must be weighed against development efforts and the capability to procure commercial equipment or forien systems to assure that the means to provide a capability is cost-effective and timely.

4. Proposed Terms of Reference: In its study of the problem the Ad Hoc Group should:

a. Prepare an annual input of proposed product improvements to existing Army systems.

b. Review product improvement management for the purpose of expediting the ID, selection, approval and funding processes.

c. Make recommendations concerning the relationship of threat analysis and planning documents to decisions regarding product improvement, i.e., assuring the improvement is warrented by the forcasted threat.

d. This Ad Hoc Group will operate on a continuing basis. Members will serve for a period of one year.

e. The Ad Hoc Group will report findings in the month of September in order to be of greatest value to R&D programming decisions and the yearly Product Improvement Program submission by Army Materiel Command.

APPENDIX C

ASAP Ad Hoc Group on Product Improvement
Summary of Conclusions and Recommendations

1. The report defines three classes of product improvements.
   a) Class I - Those needed to correct deficiencies in existing materiel.
   b) Class II - Those needed for the Army to comply with public laws, allow for extension of service life, improve cost effectiveness and effect low priority modifications.
   c) Class III - Those needed to improve operational capability.
2. Class I (Deficiency Correcting) - Conclusions and Recommendations.
   a) Conclusions.
      (1) Traditional failure analysis and "quick fix" approaches are used.
      (2) Over-emphasis on safety could impair operational capability.
      (3) Lack of failure definitions cause friction between developer and user.
      (4) The ASAP can be helpful in this class.
      (5) Unforeseen deficiencies are inevitable, but are treated operationally and on a funding basis as if they are not expected.
   b) Recommendations.
      (1) Support increased approval delegation to USAMC.
      (2) Use statistical analysis of failures.
      (3) Develop techniques to assure all available and necessary Army resources can be applied to problem.
      (4) Original developer should be used as opposed to maintenance engineering elements on these problems.
      (5) Develop failure criteria related to operational objectives, examine effect of safety fixes on operational capability, train user in philosophy of systems as well as technology and involve him earlier in development cycle.

(6) Technical disciplines available on ASAP should be used on a selective basis.

(7) Continuing ASAP panel should review difficult Class I product improvements. Panel should serve as mechanism for ASAP involvement.

(8) Expect unforeseen deficiencies. Charge AMC with job of expedited correction of deficiencies and necessary planning.

3. Class II (Extended Life) - Conclusions and Recommendations.

a) Conclusions.

(1) Lack of higher headquarters guidance to commodity commands results in rejection of PIP's and wasted manhours.

(2) Equipment Improvement Recommendations result in few product improvement porposals.

(3) Reliability enhancement through product improvement is a fact of life for newly deployed technically complex equipment.

(4) Application of the "design to unit production cost" concept may increase dollars spent to improve reliability, availability and unatainability of new systems.

(5) Class II programs could benefit by using ASAP expertise in RAM and general systems analysis.

b) Recommendations.

(1) DA should provide technical and funding guidance.

(2) Study usefulness of Equipment Improvement Recommendation System.

(3) Augment TAERS/TAMMS/Sample Data Collection information with engineering information. Involve materiel design people in the design of the data system.

(4) Incorporate reliability growth modeling and estimates in product improvement proposals as a program cost estimating tool.

(5) Do not apply the design to unit production cost method to the degree that system growth is inhibited.

(6) ASAP panel should study some projects in this class with emphasis on systems to which the design to cost concept has been applied.

4. Class III (Improved Operational Capability) - Conclusions and Recommendations.

a) Conclusions.

(1) Class III product improvement programs are small in number but are high dollar consumers.

(2) AMC does not have an element designated to identify, represent and involve the user (including commands other than TRADOC) in the product improvement process.

(3) Commercial "off-the-shelf" developments and technology should be employed to a greater extent.

(4) Funding distinctions and definitions should be clarified with respect to this class.

(5) ASAP can be of greatest assistance in this category.

b) Recommendations:

(1) ASAP continuing panel on product improvement should assign first priority to this category.

(2) AMC should develop and implement a line user oriented organization with a significant role in the control and managemet or project funds to perform a function similar to a marketing element in industry.

(3) Place emphasis on trade-offs between new starts and product improvements.

(4) Class III product improvements should fit into a long range plan to achieve improved capabilities with materiel systems.

(5) The DA Comptroller should assist in clarifying funding distinctions and definitions.

(6) Reliability growth methods should be applied in this category.

(7) Exercise caution in the use of the "design to unit production cost" concept.

5. Most Significant Recommendations.

a) Support increased delegation of HQAMC and commodity commands.

b) Increased capability should be part of long range plans for systems. Deficiencies should be expected with new systems and planned for. Statistical analysis of failures should be applied. DA guidance should be provided to permit better prioritization of PIP's in the Extended Life Class.

c) AMC should develop a user-oriented organizational element to communicate with TRADOC, major commands and other identified users to perform a marketing function.

APPENDIX D

September 16, 1974

Dr. Marvin E. Lasser, Executive Director
Army Scientific Advisory Panel (DARD-2CA)
Headquarters, Dept. of the Army
The Pentagon, Room 3E 424
Washington DC 20310

Dear Marv:

The final report of the first ASAP Panel on Product Improvement is finished. It contains the summary which you requested and modifications as suggested by General Miley in his letter to you, dated 23 July 1974. It will be published shortly.

The final meeting of the Product Improvement Panel was held on Tuesday, August 27 at the Pentagon. The purpose of the meeting was to develop a proposal for the direction of a continuing panel on product improvement. To accomplish this four of the most costly Army product improvement programs were reviewed. These were the M110E-2 self-propelled howitzer, M-60A1E3 tank, OV1-D Mohawk Aircraft Conversion, and the Pershing product improvement. It was concluded that the ASAP could be helpful with regard to the M110E-2, the M-60A1E3, and the OV1-D. No role of significance for the ASAP was envisioned for the Pershing PI program.

With regard to the M110E-2, M-60A1E3, and the OV1-D the following comments are pertinent:

1) M110E-2

This program represents aproduct improvement that started with a reliable system to achieve a greater range. Although improved range was achieved, the entire gun question is still left with the opportunity of expanding soft recoil into higher caliber. It would seem prudent to direct major effort to this opportunity and consider the trade-offs involved in regard to more PI, or a different kind of PI, or a new approach to the central problem. In regard to this entire subject it was observed that gun programs of the type represented by the M110E-2 seem to be deficient in adequate prediction of propellant effects from interior ballistic modeling techniques. We believe that there is a close relationship between solving the soft recoil problem in high caliber guns and advances in interior ballistic modeling techniques.

2) M-60A1E3

Since this product improved tank and the XM-1 are expected to provide the USA tank capability into the 21st century an ASAP Panel should help to:

Predict the technologies (and expected rate of growth of these technologies) that will cause the present M-60A1E3 tank to be outmoded. The technologies that the Army should then consider in the next PI phase for the M-60A1E3 should be developed. A determination should be made with regard to future technologies appropriate to the XM-1 tank as opposed to further PI on the M-60A1E3. With regard to suspension systems for the M-60A1E3, could the ASAP provide suggestions to help alleviate problems or is there a technology that would allow the Army to leap frog present technologies?

3) OV1-D

This is an older program which has suffered to some extent from continuous budget attritions. A significant contribution could not perhaps be made by the ASAP to the OV1-D program per se. The OV1-D is, however, the data acquisition subsystem of a much larger command and control system. A significant contribution could possibly be made if a study were conducted that viewed the OV1-D and the present planned program in its total system context. The inclusion of a data link to provide more timely data to the commander is an example of a potential PI that is presently being considered. The whole interaction of the OV1-D data acquisition subsystem with the commander's data processing and communication subsystem and the effect on the response subsystem should be considered in PI programs aimed at upgrading the OV1.

The Panel further recommends that a continuing product improvement ASAP Panel should concentrate in depth on only one of the above. There is no further need for a broad study such as the one which has just been concluded.

With this effort I believe that the first ASAP Panel on Product Improvement has completed a study and report that is in accord with the terms of reference that were provided. The Panel hopes that the results have been useful.

Sincerely,

Dr. James J. Renier
Vice President
Aerospace & Defense Group

JJRenier/kw

copies to: Lt. Col. A.N. Bone
Lt. Col. Gerald R. Holland
Dr. Vincent S. Haneman, Jr.
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Dr. William A. Rostoker

APPENDIX E

List of Attendees at Each of the Three Commands That Were Visited by the Ad Hoc Group

1) M107/M110 PROGRAM
DATE OF VISIT: DECEMBER 7-8, 1975

PRELIMINARY REPORT ON VISIT OF ASAP AD HOC GROUP ON PRODUCT IMPROVEMENT TO ROCK ISLAND ARSENAL ON DECEMBER 7-8, 1975 TO REVIEW M107/M110 PRODUCT IMPROVEMENT PROGRAM

The following visitors were in attendance representing the Ad Hoc Group on Product Improvement:

Mr. Eugene Carbonneau	HQ-DA
LTC. Harold Ford	HQ-DA
Dr. M.C. Curtiss, Jr.	Princeton University
Dr. G. Reethof, Chairman	Penn State University
Dr. R.D. O'Neal	KNS Industries
Dr. V.S. Haneman, Jr.	Auburn University
Dr. W. Rostoker	University of Illinois, Chicago

The following personnel from ARMCOM were in attendance:

LTC. B.A. Huggin	AMCPM - M110 E2
R. McKilligan	
P. Fellman	HQ ARMCOM, AMSAR - MAW
S. Smith	AMCPM - M110 E2 - TM
M. Dietrich	AMSAR - ASA
Maj. C.A. Hubbard	AMSAR - ASA
S.J. Schornstein	AMSAR - RDG
C.E. Bradley	AMCPM - M110 E2 - TM
A. Dupont	RIA - SA RRI - LA - 4430
A. Dillin	AMSAR - QAR
L. Murray	AMSAR - QAR

Also present were:

D.J. Lewis	Frankford Arsenal, SARFA - FCA
C. Szybka	TACOM
Maj. F. Johnston, Jr.	USA FABD, At2R - BDT, - Ft Sill
Cpt. D. Rohler	D CD/TRADOC, ATSF - CD-C, Ft Sill
J. Calarusso	USAMC - AMXMD - EV
E.H. Weber	USAMC - AMCMA - SE

2) M60A1 PROGRAM
DATE OF VISIT: MARCH 12, 1976

PRELIMINARY REPORT ON VISIT OF ASAP AD HOC GROUP ON
PRODUCT IMPROVEMENT TO TANK-AUTOMOTIVE COMMAND
WARREN, MICHIGAN ON 12 MARCH 1976 TO REVIEW
M60A1 TANK PRODUCT IMPROVEMENT PROGRAM

The following visitors were in attendance representing the Ad Hoc Group on Product Improvement:

Mr. Eugene Carbonneau	HQ-DA
LTC. Harold L. Ford	HQ-DA
Dr. Howard C. Curtiss, Jr.	Princeton University
Dr. Vincent Haneman, Jr.	Auburn University
Dr. William Rostoker	University of Illinois, Chicago
Dr. Gerhard Reethof, Chairman	Penn State University

The following persons from the Tank-Automotive Command were in attendance:

Col. Dan H. Williamson	P.M. DRCPM - M60 TD
Maj. K. Herm	Asst P.M. DRCPM - M60 TD
Maj. J.E. Getz	Asst P.M. DRCPM - M60A1
Maj. H. Miller	R & D Coordinator - DRCPM
Mr. J.J. Reeves	DRCPM - M60 TD - M60 TD
Mr. G.A. Van Der Waerden	DRCPM - M60TD - T
Mr. T. Maynund	DRCPM - M60TD - T
Mr. N.G. Loridas	DRCPM - M60TD - T
Mr. D.J. Brennan	DRDTA - R

The following persons were present from Headquarters DARCOM:

Col. Lloyd A. Gimple	DRCPI
Mr. R.J. Ruth	DRCPI

3) OV1D PROGRAM
DATE OF VISIT: APRIL 1, 1976

ATTENDEES
ARMY SCIENTIFIC ADVISORY PANEL
1 APRIL 1976

NAME	ORGANIZATION	ADDRESS
Gary Reethof	ASAP - Penn State University	University Park PA
Vince Haneman	ASAP - Auburn University	Auburn AL
Gene Carbonneau	HQDA ODCSRDA (DAMA-PPM-M)	The Pentagon
Lloyd Gimple, COL.	HQ CARDOM DRCPI	Alexandria VA
Doug Leach	HQ DARCOM DRCPI	Alexandria VA
Gary Moore	HQ DA OACSI	Washington DC
Michael D. O'Byrne, CPT.	USAICS (ATSI-CD-MD)	Ft. Huachuca AZ
George Holubasch (Acting OV1D P.M. Engineer)	SEMA PM	AVSCOM
Floyd Rogier (Field Office at AV)	ECOM	ECOM - St. Louis MO
C. Lehares (Field Office at AV)	ECOM	ECOM - St. Louis MO
J. Weber (Weapon Systems Mgmt. Product Improvement)	DRSAV-WPM	AVSCOM
A.J. Mozelewski (Config. Control Controls PIP Process)	DRSAV-EKC	AVSCOM
James E. Mitchell (Maintenance Systems Engineering on OV1D)	DRSAV-FEW	AVSCOM
Jack Kane (OV1D Ecom. Mgr.)	DRSEL-SI-AV	HQ ECOM Ft. Monmouth NJ
William Rostoker	ASAP - Univ of Illinois	Chicago IL
H.C. Curtiss	ASAP - Princeton Univ	Princeton NJ
J.J. Top, LTC(P)	SEMA PM	AVSCOM
John Sautman (Deputy Product Mgr.)	SEMA PM	AVSCOM

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Dr. Vincent S. Haneman, Jr. Dean, College of Engineering Auburn University Auburn, AL 36830	1
Dr. Russell D. O'Neal 3889 Waldenwood Ann Arbor, MI 48105	1
Dr. William A. Rostoker Professor of Metallurgy College of Engineering Department of Materials Engineering University of Illinois Box 4348 Chicago, IL 60680	

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Investigation of three major Product Improvement Projects
Analysis of Product Improvement Process
Time lapse from identification of need to equipment retrofit
Need for mechanism to allow contractor-initiated PIP
Necessity for early user representative participation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The group investigated three major product improvement (PI) programs to examine and evaluate the PI process and make recommendations which would provide guidance for improvement of the process. It was to make recommendations concerning the continued involvement of ASAP expertise in the process.

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